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NOTICE OF ALLOWANCE AND FEE(S) DUE

22850 7590 06/17/2009

OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

TORRES, JUAN A

ART UNIT

PAPER NUMBER

2611

DATE MAILED: 06/17/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/586,366

07/18/2006

Masatsugu Higashinaka

292763US2PCT

3002

TITLE OF INVENTION: RECEIVER APPARATUS USING MAXIMUM-LIKELIHOOD-DETERMINATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	09/17/2009

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

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22850 7590 06/17/2009

OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/586,366 07/18/2006 Masatsugu Higashinaka 292763US2PCT 3002

TITLE OF INVENTION: RECEIVER APPARATUS USING MAXIMUM-LIKELIHOOD-DETERMINATION

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional NO \$1510 \$300 \$0 \$1810 09/17/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
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TORRES, JUAN A 2611 375-341000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/586,366	07/18/2006	Masatsugu Higashinaka	292763US2PCT	3002
22850	7590	06/17/2009	EXAMINER	
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			TORRES, JUAN A	
			ART UNIT	PAPER NUMBER
			2611	
DATE MAILED: 06/17/2009				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 567 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 567 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	10/586,366	HIGASHINAKA, MASATSUGU	
	Examiner	Art Unit	
	JUAN A. TORRES	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Response to Election / Restriction Filed on 06/03/2009.
2. ☒ The allowed claim(s) is/are 5-7 (renumbered 1-3).
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>07/18/2006 and 04/21/2008</u> 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | <ol style="list-style-type: none"> 5. <input type="checkbox"/> Notice of Informal Patent Application 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 9. <input type="checkbox"/> Other _____. |
|--|---|

/Juan A Torres/
Primary Examiner, Art Unit 2611

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group III claims 5-7 in the reply filed on 06/03/2009 is acknowledged.

Claims 1-4 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Groups I and II, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 06/03/2009.

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 07/18/2006 and 04/21/2008 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Specification

The title of the invention has been changed to: "Receiver apparatus using maximum-likelihood-determination"

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

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The application has been amended as follows:

claims 1-4 are cancelled

Allowable Subject Matter

Claims 5-7 (renumbered 1-3) are allowed.

The following is an examiner's statement of reasons for allowance: claims 5-7 (renumbered 1-3) are allowed because a comprehensive search of prior art failed to teach, either alone or in combination, a receiving apparatus that uses a maximum-likelihood- determination method as a method of determining reception data, and executes a determination process using an analog- to-digital-converted reception signal, the receiving apparatus comprising a transmission-path estimating unit that estimates a transmission-path response matrix of a radio transmission path based on the reception signal, a matrix processing unit that decomposes the transmission-path response matrix into an upper triangular matrix, and multiplies the reception signal by an inverse matrix of the transmission-path response matrix, a provisional determining unit that provisionally determines a transmission signal based on a result of multiplication of the reception signal by the inverse matrix of the transmission-path response matrix, a metric calculating unit that calculates a metric based on a result of the provisional determination, the decomposed transmission-path response matrix, and the result of the multiplication, a comparing unit that compares a metric obtained as a result of the calculation by the metric calculating unit with an updated metric, and outputs a smaller metric, an estimate-symbol determining unit that forms a hypersphere centering around a reception signal point based on a specific value representing a radius of the

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hypersphere or the updated metric, from a result of comparison by the comparing unit, generates a candidate of an estimate symbol based on the decomposed transmission-path response matrix and the result of the multiplication, and determines whether the candidate of the estimate symbol is present within the hypersphere, and a metric updating unit that calculates a metric based on the candidate of the estimate symbol obtained as a result of the determination by the estimate-symbol determining unit and the result of the multiplication, stores a minimum metric from among metrics calculated in the past and the candidate of the estimate symbol corresponding to the minimum metric, compares a newly calculated metric with a currently stored metric every time when the metric is newly calculated, and updates stored information when the newly calculated metric is smaller than the currently stored metric, wherein the metric updating unit repeats the update process until the estimate-symbol determining unit determines that no candidate of the estimate symbol is present within the hypersphere, and sets the candidate of the estimate symbol that corresponds to a final minimum metric as a maximum-likelihood-determination value, as the applicant has claimed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

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- a) Damen, "On maximum-likelihood detection and the search for the closest lattice point," IEEE Transaction on Information Theory, vol. 49, pp. 2389-2402, October 2003.
- b) Bhouri, "A new QRD-based block adaptive algorithm", Proceedings of the 1998 IEEE International Conference on Acoustics, Speech and Signal Processing, 1998 Volume 3, 12-15 May 1998 Page(s):1497 - 1500 vol.3
- c) Boudreau, "Adaptive equalization of CPM signals transmitted over fast Rayleigh flat-fading channels" IEEE Transactions on Vehicular Technology, Volume 44, Issue 3, Aug. 1995 Page(s):404 – 413
- d) Letaief, "Joint maximum likelihood detection and interference cancellation for MIMO/OFDM systems", VTC 2003-Fall. 2003 IEEE 58th Vehicular Technology Conference, 2003, Volume 1, 6-9 October 2003 Page(s):612 - 616 Vol.1
- e) Boudreau, "Adaptive equalization of CPM signals in a fast flat-fading environment", Personal Communications: Gateway to the 21st Century. Conference Record., 2nd International Conference on Universal Personal Communications, 1993, Volume 2, 12-15 October 1993 Page(s):936 - 940 vol.2
- f) Greenberger (US 6675187 B1) discloses a pipelined linear array of processor elements for performing matrix computations.
- g) MacMartin (US 20030060903 A1) discloses a system for computationally efficient adaptation of active control of sound or vibration.
- h) Oprea (US 20040192218 A1) discloses channel data transmission in wireless communication systems.

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- i) Dogan (US 6658234 B1) discloses extending the effective dynamic range of a radio receiver system.
- j) Narasimhan (US 7505788 B1) discloses spatial multiplexing with antenna and constellation selection for correlated MIMO fading channels.
- k) Walton (US 20030125040 A1) discloses Multiple-access multiple-input multiple-output (MIMO) communication system.
- l) Sayeed (US 7218906 B2) discloses layered space time processing in a multiple antenna system.
- m) Hassibi (US 6600796 B1) discloses receiving wireless transmissions using multiple-antenna arrays.
- n) Sandhu (US 20050152484 A1) discloses a multicarrier receivers and methods for separating transmitted signals in a multiple antenna system.
- o) Karnin (US 7035354 B2) discloses CDMA multi-user detection with a real symbol constellation.
- p) Brunel (US 20020126772 A1) discloses Accelerated method of detection by spheres.
- q) Wang (US 7317770 B2) discloses Near-optimal multiple-input multiple-output (MIMO) channel detection via sequential Monte Carlo.
- r) Lakshmipathi (US 7352819 B2) discloses Multiantenna communications apparatus, methods, and system.
- s) Pautler (US 20030185309 A1) discloses a transceiver for controlling a multiple-input, multiple-output communications channel .

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- t) Misra (US 6831944 B1) discloses reduced computation in joint detection.
- u) Agee (US 20040095907 A1) discloses optimization of wireless multipoint electromagnetic communication networks.
- v) Branlund (US 7110349 B2) discloses adaptive communications methods for multiple user packet radio wireless networks.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JUAN A. TORRES whose telephone number is (571)272-3119. The examiner can normally be reached on 8-6 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Juan Alberto Torres
06/09/2009

/Juan A Torres/
Primary Examiner, Art Unit 2611